Controlling Poultry Respiratory Diseases

NC-1180 (2009-2014)

Poultry Production and Consumption Threatened by Respiratory Diseases

Photo by Scott Bauer, USDA.

The U.S. is the world's largest producer and second largest exporter of poultry meat. In the U.S., poultry meat and egg production has been continually increasing, and consumption has surpassed all other meats. Surveys show that consumers prefer chicken over beef and pork in terms of taste, versatility, ease of preparation, nutrition value, consistency of quality, and price. In 2007, the combined value of production from broiler chickens, eggs, turkeys, and chicken sales was $31.9 billion; however, the efficiency and competitiveness of the poultry industry is seriously threatened by respiratory diseases. These include infections caused by laryngotracheitis, bronchitis, and lentogenic Newcastle disease viruses, *E. coli* and other bacteria, and fungi. Infection often results in poor performance (e.g., decreased growth) and high medication costs, racking up huge losses for producers. Condemnation at processing and strict export restrictions add to these losses, impacting the industry and economy nationwide. Some respiratory disease agents are also classified as agrobioterrorism agents requiring modified biosecurity measures. In order to protect the nation's food supply and the economic well-being of farmers and the poultry industry, more research is needed to develop rapid diagnosis and control of major respiratory diseases.

Multistate Research Project Improves Diagnostic Tools and Control Strategies

In 2009, Multistate Research Project NC-1180 formed to develop effective long-term strategies to control poultry respiratory diseases. The multistate approach has generated solutions that are practical for diverse poultry systems and specific pathogens impacting farms across the U.S. During the past five years, researchers identified reservoirs of infectious agents in wild birds and factors involved in transmission to commercial poultry. Researchers also improved diagnostic capabilities, including multiple real-time and rapid on-farm tests to detect infection status and identify specific disease strains. Scientists also collected samples and characterized emerging respiratory disease agents. To develop vaccine candidates, scientists identified key genes and antigens associated with protective immune response.

Photo by Stephen Ausmus, USDA.

Research and Extension Help Poultry Industry Remain Competitive and Profitable

Building on study results, NC-1180 developed new strategies for managing poultry respiratory diseases. Faster, more accurate diagnosis and more effective control options, including vaccines, have reduced poultry deaths, sickness, and condemnation. This has enabled the poultry industry to remain competitive and profitable. In turn, consumers continue to enjoy safe, healthy, and affordable poultry meat and eggs. In addition, new vaccines and refined biosecurity practices have reduced the risk of these diseases spreading to humans.

Reducing Risk of Transmission

- Wild birds are a reservoir of avian influenza and other viruses, and some species may serve as intermediate hosts. For example, ducks infected with highly virulent strains of avian influenza viruses shed the virus for long periods of time, perpetuating the virus in the environment and increasing the possibility of transmission to commercial poultry. Researchers have suggested ways to eliminate viruses in the environment, including disinfecting poultry houses,

Photo by Keith Weller, USDA.

composting litter for three days, improving beetle and rodent control, and treating drinking water with commercial biofilm removers. These practices have reduced the incidence and severity of outbreaks on many farms.

- Researchers discovered that some viruses can replicate in the reproductive tract, which means the viruses can be sexually transmitted and can be found in or on eggs. In hens artificially inseminated with semen containing infectious bronchitis virus, egg internal and external quality was negatively affected. Researchers also detected low pathogenic influenza viruses inside the eggs of infected turkeys. Following these findings, researchers suggested better practices for egg handling and movement to reduce transmission through contaminated cracked eggs and egg flats.

New Vaccines and Vaccine Practices

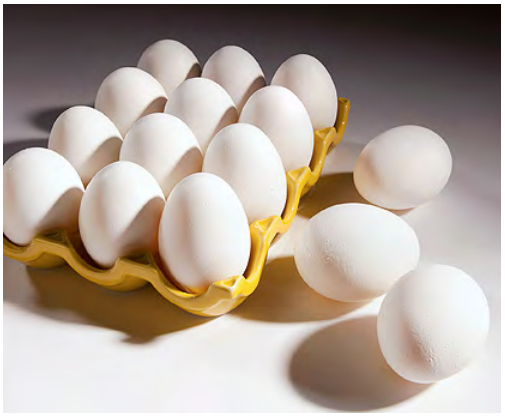
- Researchers developed a plant-based vaccine for avian influenza. This type of vaccine can be easily fed to poultry. This vaccine has promising potential for poorer countries, which are a major source of poultry influenza infections, but lack access to high-tech vaccination tools. Newcastle disease virus vaccine candidates developed by NC-1180 researchers are being evaluated by a vaccine company for distribution worldwide. In addition to providing immunization against Newcastle disease, these new vaccines decrease the amount of virus shed into the environment by vaccinated birds. Other studies demonstrated that chicken interferon is biologically active against the pandemic H1N1 avian influenza virus, making it a possible treatment.
- Researchers also identified vaccination practices that reduce the risk of transmission through decreased shedding. For example, recombinant laryngotracheitis vaccines do not prevent virus shedding, whereas chicken embryo origin vaccines provide significant protection against shedding. Other studies showed that in-ovo vaccinations are much safer than the live vaccines currently used against infectious bronchitis. Scientists also noted that reducing the number and diversity of live virus vaccines given at the same time as laryngotracheitis vaccines may optimize protection against laryngotracheitis.

Rapid Diagnostics

- NC-1180's genomic sequence data for viruses has led to improved diagnostic tests. Researchers developed a new test for laryngotracheitis and avian influenza viruses. This test is faster, more sensitive, and cost effective because it does not require sophisticated equipment. With the new test, researchers can quantify the viral load of laryngotracheitis in chickens, providing valuable data for estimating transmission and control. A tool to rapidly identify *M. gallisepticum* infection without the use of expensive technology was also developed. In addition, scientists developed an influenza screening tool that can be used in vitro, reducing the use of live animals and research costs. The group also created a tool to rapidly identify multiple avian influenza types in the same sample. This tool can identify infected flocks in large populations of vaccinated poultry. The National Animal Health Laboratory Network adopted two tests developed by NC-1180 that allow real-time differentiation between North American and pandemic H1N1 influenza viruses.

Emerging Risks

- NC-1180's continued monitoring of infectious pathogens in commercial poultry is important for evaluating the effectiveness of vaccination programs. Close monitoring also helps isolate and characterize field pathogens that break through immunization, giving scientists and farmers a chance to prevent serious, costly outbreaks. Furthermore, more sensitive diagnostic tests ensure that the circulating viruses are properly identified.



NC-1180 identified practices for inactivating Newcastle disease and avian influenza viruses in eggs. Photo by Peggy Greb, USDA.

NC-1180 member Dr. Chang-Won Lee tests the virulence of particular virus strains, how they interact with other pathogens, and how they respond to various vaccines. Photo by Ken Chamberlain, Ohio State University Marketing & Communications.

Want to know more?

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